Bridge Falsework Forum
Holiday Inn – North
Sacramento, CA
October 15, 2007

1. PURPOSE

1. 1. Construction of falsework is a high-risk operation.

1. 2. Contractors, their employees, Offices of Structure Construction staff, private consultants and the general public are at risk in the event of unplanned events with falsework.

1. 3. Public safety is a joint responsibility between the contractor and the owner (State).

1. 4. With the most recent incident occurring the same week as the Minneapolis I-35 bridge the press reported it as a bridge collapse that received the attention very high up in California government and on the national news wire services.

1. 5. We are taking this time to discuss how to ensure that constructed falsework is stable and safe.

1. 6. The feedback from today's forum will be used to update best management practices through the Falsework Manual.

1. 7. Revised Specifications may be issued to ensure that all contractors are held to the same requirements when designing, constructing and removing falsework.

2. FALSEWORK FORUM NOTES

2. 1. Action Items will be captured

2. 2. All notes will be posted on the Internet

2. 3. The following is the URL for the location of the notes: www.dot.ca.gov/hq/esc/construction/construc.htm

2. 4. The Division of Engineering Services (DES), Offices of Structure Construction (OSC), hosted the forum.

3. PROGRESSION OF MEETINGS RELATED TO FALSEWORK STABILITY

3. 1. After the most recent incident (where falsework fell across and blocked Route 149 a major highway in northern California) the DES Chief requested that OSC meet with the industry and get their input on how to prevent falsework from collapsing. OSC management decided that a three-step approach was needed to ensure that all sectors of the industry had an opportunity to comment on what was needed. The first meeting would be with the internal OSC Technical Team for Falsework, the second would be with the Joint Caltrans/Industry Falsework Advisory Team, and the third would be with the decision makers of the bridge construction industry. The intent was to carry ideas and recommendations forward in the progression of meetings, to foster discussion and ensure that all ideas were heard.

3. 2. INTERNAL FALSEWORK TEAM – OSC developed technical teams to cover the fifteen (15) primary areas that their work covers with falsework being one of those teams. The falsework team is comprised of OSC Bridge Construction Engineers (Senior Bridge Engineers). The falsework team met and developed a list of recommendations that they felt would help to ensure falsework stability. This list was carried forward to the next meeting of the Joint Caltrans/Industry Falsework Advisory Team.

3. 3. JOINT CALTRANS/INDUSTRY FALSEWORK ADVISORY TEAM – This team was formed after the 2005 Bridge Construction Forum to ensure that an avenue for open communication between the industry and OSC was maintained. This team meets quarterly. The team is comprised of the OSC Falsework Engineer, OSC's falsework technical team members and falsework design representatives from the following contractors; CC Myers Inc, FCI, Granite Construction Co., Washington Group, Skanska, and ERRECA's. The list of recommendations from the technical team meeting and the list generated at this meeting were reviewed and joined to take forward to the Bridge Falsework Forum.

4. ADVISORY TEAM RECOMMENDATIONS – STABILITY

4. 1. Traffic Opening requirements

4. 1. 1. Independently stable/ stand-alone frames – How is this condition achieved? The idea of requiring moment resisting frames was not popular.

4. 1. 2. Connection criteria – The group questioned whether clamping every beam would be a solution. One contractor stated that they bolt their connections between the cap and stringers. Others questioned the issues they would have from CT inspectors if beams (stringers) started appearing with numerous holes in the flanges. What testing has actually been done on C-clamps? Are they being used strictly as tested and approved? C-clamp use limits are stated in the falsework manual. Doing away with the allowance for Friction Transfer Capacity (FTC) was suggested.

4. 1. 3. It is customary to increase the load to be resisted when risks from collapse are increased. It was stated from the group that this is a wrong priority based upon what has been seen from work performed by other agencies. The emphasis should be on the missing member rather than arbitrarily increasing loads. It was noted that recent failures have not been due to lack of design capacity.

4. 1. 4. Continuity between structure columns – Require connections to transfer longitudinal and lateral loads between columns.

4. 1. 5. Implementation – Brief discussion on whether changes decided upon should be made in the Falsework Manual or in the Specifications. Whatever the outcome is, there is a need to ensure a level playing field for all at bid time, which may lead one to believe that a specification change would be the better option.

4. 2. Communication/Partnering/ Falsework Design Plans
    4. 2. 1. Require meetings at critical benchmarks
        4. 2. 1. 1.Erection
        4. 2. 1. 2.Grading
        4. 2. 1. 3.Removal
        4. 2. 1. 4.Prior to opening to traffic (for falsework over traffic)

        The extent of the meeting would be relative to the size of the job. Tailgate meetings might suffice for a small simple span bridge not over live traffic.
4. 3. Communication/Partnering/ Falsework Design Plans
    4. 3. 1. Erection and Removal Plans – Discussion questioned why the erection and removal plans needed to be a part of the design plan? This is a construction issue, not a design issue. Sometimes the falsework needs to be designed with erection and removal in mind.
    4. 3. 2. General at time of falsework plan submittal - The thoughts were that the Designer is able to provide a general plan of removal but it is up to the construction crew that is aware of their capabilities and available equipment to develop the site specific plan. As previously mentioned, this is not always practical. There are instances where falsework must be designed for specific erection and removal restrictions.
    4. 3. 3. Detailed at pre-activity meeting – The idea is that the more detailed plan for erection and/or removal could be submitted, reviewed and approved during a meeting prior to the contractor performing the work.
    4. 3. 4. Implementation – Implementation of these “requirements” could be initiated via the falsework manual or made part of the Contract Standard Specifications or the Special Provisions.
4. 4. Falsework Engineer of Record Presence and Approvals
    4. 4. 1. At Critical benchmarks
        4. 4. 1. 1.Certify prior to traffic opening (for falsework over traffic)

4. 4. 1. 2.Onsite during grading operations - Consider having the falsework engineer there (on-site) when any adjustments or grading are being done, not just to certify the falsework before opening to traffic. Having the falsework engineer on site to approve the falsework just before we have to open to traffic is not practical. It is not realistic to have us hold traffic on major interstate, given the penalty. This is why it is essential to set and meet milestones during the operation.

4. 4. 1. 3.Progressive stages of construction - There are a limited number of falsework designers, it is not possible for the actual designer to be on site at all of the "critical" stages of falsework Construction.

4. 4. 2. Discussion - Traffic windows issue is critical. In the past, before late openings of traffic closures had fines attached to them, the contractor and the Structure Representative ensured that the falsework was safe prior to opening, even if it meant delaying the opening. Now with delays costing thousands of dollars per minute, the joint effort and extra care that went into the project before it was opened to traffic seems to have disappeared or is greatly reduced.

4. 4. 3. Implementation - Implementation of these "requirements" would probably have to be made as changes to the Contract Standard Specifications or the Special Provisions.

4. 5. Best Practices (Internal by Contractor)

4. 5. 1. Training - the more you can get scheduled, the better off we all will be. There are not enough people available with experience. (Laborers, Carpenters, Pile Butts etc…) The Union offers some basic falsework training.

4. 5. 2. Company Certification - As contractors are using different systems, individual contractors should do internal training and certification. Some contractors are already doing this.

4. 5. 3. Implementation - This could be required by Spec or as a Best Management Practice in the Falsework Manual.

4. 6. Rewrite Falsework Manual, Bridge Construction Memos, Specifications

4. 6. 1. Longitudinal Stability Analysis – Add more examples to the falsework manual

4. 6. 2. Friction Transfer Capacity (FTC) Allowance – Doing away with it was proposed.

4. 6. 3. Testing and use of clamps – C-clamps are sometimes being used improperly. Clarify limits of use in the falsework manual. Provide basis for use and capacity via testing.

4. 6. 4. Solutions suggested

5. GROUP DSCUSSION

5. 1. Caltrans needs to send out information on incidents – None of us wants to duplicate a mistake. Industry needs to know what happened so they can prevent re-occurrence. Caltrans is moving toward doing this in a way that will avoid legal issues.

5. 2. Risk – what is the acceptable level of risk? What is acceptable? How do we mitigate the risk?

5. 3. Seems like most of the past incidents all revolve around human error and common sense. How do we legislate common sense? Most of the problems seem to be individual human performance, not specs or procedures related.

6. WINCHES FOR FALSEWORK REMOVAL

6. 1. Traffic window limitations

6. 2. Operation cannot be reasonably done otherwise

6. 3. Does not encroach upon the vertical and horizontal traffic clearances

7. Winches – Advisory Team Recommendations

7. 1. Redundant systems may be required

7. 2. Use High Strength rods or strands and winches.

7. 3. High strength rods or strands

7. 3. 1. Requires redundant system

7. 3. 2. Requires use of new strand

7. 4. Winches only

7. 4. 1. Safety factor (5:1)

7. 4. 2. Certification – Winches are to be tested and certified on a regular basis

7. 4. 3. Inspection of critical elements (NDT)

7. 5. Implementation – (Possibly by CCO.) Specs may be re-written.

7. 5. 1. Provide additional direction to field staff as to what's allowable.

7. 5. 2. Update Falsework Manual

8. DISCUSSION / COMMENTS ON WINCHING FROM THE GROUP.

8. 1. Redundancy – Where to you cap the redundancy.

8. 2. Why is this on the table to change? Some contractors don't approve of winches supporting falsework over live traffic.

8. 3. Caltrans needs to have a uniform application statewide and needs to define "suspended load."

8. 4. Caltrans should take a better look at the design process. Go to using more pre-cast.

8. 5. Traffic is driving the design, and not constructability. Temporary structures are getting to the point that they are prohibitive in cost and time to erect.

9. NEXT STEPS

9. 1. Caltrans will keep industry involved in this discussion.

9. 2. Falsework advisory group meets quarterly. Attendance is open to all contractors and engineers involved in the design and construction of bridge falsework.